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ABSTRACT

Reported are four studies on methods to increase the production rates of severely and profoundly retarded adults in the sheltered workshop setting. It is explained that all four Ss had undergone intensive training on a complex task, were able to perform the task at a reasonably high rate, but did not usually maintain a high rate in the production setting. The four studies describe effects of differential reinforcement, retraining, self delivery of reward, and psychoactive drugs on Ss' production rate. (DB)

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Considerations in Dealing with Low Production Rates of Severely Retarded Workers

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Considerations in dealing with the low production rates of severely retarded workers

Increased attention is being paid to the possibility that severely and profoundly retarded adults may function as viable members of a community's work force (Bellamy, Inman, & Horner, in press; Martin & Pallotta, in press). Research assessing training (Bellamy, Peterson, & Close, 1975; Clarke & Hermelin, 1955; Crosson, 1967; Gold, 1974, 1976; Hunter & Bellamy, 1976; Irvin & Bellamy, 1977; Loos & Tizard, 1955; O'Neill & Bellamy, in press) and production (Bellamy, Note 1; Bellamy, Inman, & Horner, in press; Bellamy, Inman, & Schwarz, in press; Gold, 1973a, 1973b; Windle, 1962) techniques with the severely retarded clearly indicates that severely retarded individuals can learn complex vocational skills when appropriate training technologies are employed. This research also suggests that skills learned during training can be adequately maintained when proper maintenance procedures are used (Bellamy, Inman, & Yeates, Note 2).

While research identifying effective training techniques is increasing, the majority of vocational research with the severely retarded has been focused on production management procedures (Bellamy, Note 1; Gold, 1973b). Specifically, researchers have been interested in the worker, task and setting characteristics that facilitate high rates of production. Recent reviews of this literature have even begun identifying guidelines for shop organization and supervisor behavior designed to optimize worker production rates (Bellamy, Inman, & Schwarz, in press; Martin & Pallotta, in press). The general focus of these guidelines, however, requires that they identify procedures <u>most</u> useful for <u>most</u> workers. Given that severely

and profoundly retarded adults are a highly variable group (Grossman, 1973), production managers will need to supplement these general guidelines with additional options.

The present paper presents four studies from workshops affiliated with the Specialized Training Program, a contract workshop at the University of Oregon which employs severely and profoundly retarded workers. Each study describes a programmatic option taken with a worker who (a) had undergone intensive one-to-one training on a complex task prior to entering production, (b) had demonstrated the ability to perform at a reasonably high rate, yet (c) was maintaining a low work rate in a structured production setting. The production settings in the studies were all highly contingent environments, in which staff contact, tokens and/or edibles were delivered only when a worker performed appropriately (cf. Bellamy, Inman, & Horner, in press; Bellamy, Inman, & Yeates, Note 2). The four studies describe effects of (a) differential reinforcement, (b) retraining, (c) self-delivery of reward, and (d) psychoactive drugs on the production rate of severely retarded workers.

Differential Reinforcement of High Production Rate

Most, if not all, workshops serving retarded adults provide workers with some type of reward during the workday. This reward may take many forms including social praise, money, edibles, tokens, or access to breaks. To the extent these potential reinforcers are available contingent on worker performance (e.g., completion of a unit of work) differential reinforcement is being used. It has generally been found that differential reinforcement is an effective method of improving production rate (Bellamy, Note 1; Bellamy, Inman, & Horner, in press; Bellamy, Inman, & Schwarz, in press;

Gold, 1973b; Martin & Pallotta, in press).

Frequently, however, the improvement in a worker's rate will still leave him or her working below an economically significant level. For these workers additional intervention procedures are necessary if the skills they acquire in training are to be vocationally viable. One option is to differentially reinforce high rates of performance such that a worker receives differentially more reward for work completed quickly. To ensure that all work completion behavior is rewarded, a modest reinforcer can be delivered for work that is done slowly, and a differentially greater reward can be made contingent upon a high performance rate. The present study examines the effects of adding differential reinforcement of high production rate (DRH) procedures to the reinforcement schedule of a worker already receiving reward for work completion.

Subject and Task

At the time of the study Eaon was 25 years old and employed in a community-based replication of the Specialized Training Program. Eaon's IQ was 25 as measured by the Stanford Binet experimental form for non-verbal and physically handicapped persons. Though he had demonstrated acceptable rates of production during training on a 520-step cable harness task, he was only performing at 13% of the industry norm following one week in the production setting.

Eaon's task involved assembly of a cable harness similar to that described by Hunter and Bellamy (1976). The cable was assembled by first sequencing 4 color-coded wires on a board. A continuous elastic cord was then used to lace the wires together with 30 self-tightening knots.

Procedure

An ABAB single subject design (Baer, Wolf, & Risley, 1968) was used to assess the effects of differential reward of high production rate. The phases of the study included (a) $Baseline_1$, (b) Differential reinforcement of high production $rate_1$ (DRH_1), (c) $Baseline_2$, and (d) differential reinforcement of high production $rate_2$ (DRH_2).

During $Baseline_1$ Eaon received social praise for completing each cable, and 5 cents when he had correctly assembled three cables. Money earned during this phase was generally used to buy a cup of coffee at breaks. Following 5 days of $Baseline_1$, Eaon entered the DRH_1 phase. During this phase he continued to receive 5 cents for completing three cables, and continued to receive some social praise for being on task. Social praise following completion of a cable, however, became contingent on a fast rate of assembly. If Eaon completed a cable within a predetermined number of minutes he received vociferous social praise. If he took longer than this time criterion he received minimal attention. His favorable response to praise during training led supervisors to assume that social praise would function as a powerful reinforcer for Eaon. At no time was money made contingent on fast working.

This schedule ensured that completion of work was always rewarded, but that completion within the time limit was differentially rewarded at a higher level. The time criterion was computed daily by taking Eaon's average rate of production over the previous five days. This method of calculating the criterion both maximized the likelihood that Eaon would experience initial success, and provided an incentive for continual improvement as his production rate improved.

To provide Eaon with feedback on the amount of time he had to meet the criterion during DRH_1, supervisors would place a piece of masking tape over a part of the crystal on Eaon's wristwatch. If the cable was completed before the minute hand went under the tape he received the higher level of social reinforcement. The DRH_1 phase lasted 14 days.

$Baseline_2$ lasted 8 days and exactly replicated the procedures of $Baseline_1$. The DRH_2 phase lasted 25 days and exactly replicated the procedures of DRH_1.

Results

During the 5 days of $Baseline_1$ Eaon averaged approximately 44 minutes for each cable assembly. As shown in Figure 1, this was only 13% of the standard rate of normal workers performing the same task.

Insert Figure 1 about here

When Eaon began receiving additional reward for high rates of performances in the DRH_1 phase, a dramatic reduction in the minutes required per cable was observed. During the last 5 days of this phase he averaged 19 minutes per cable. This is clearly a significant improvement over the $Baseline_1$ phase.

When differential reward of high production rate was terminated, and the $Baseline_2$ phase begun, there was an immediate increase in the number of minutes Eaon took to complete a cable. As shown in Figure 1, both the level and slope of $Baseline_2$ data indicate a deterioration of production performance in this phase.

A return to differential reward procedures in the DRH_2 phase produced a shift in both the level and slope of the production rate data. During DRH_2 Eaon gradually decreased the number of minutes required for each cable

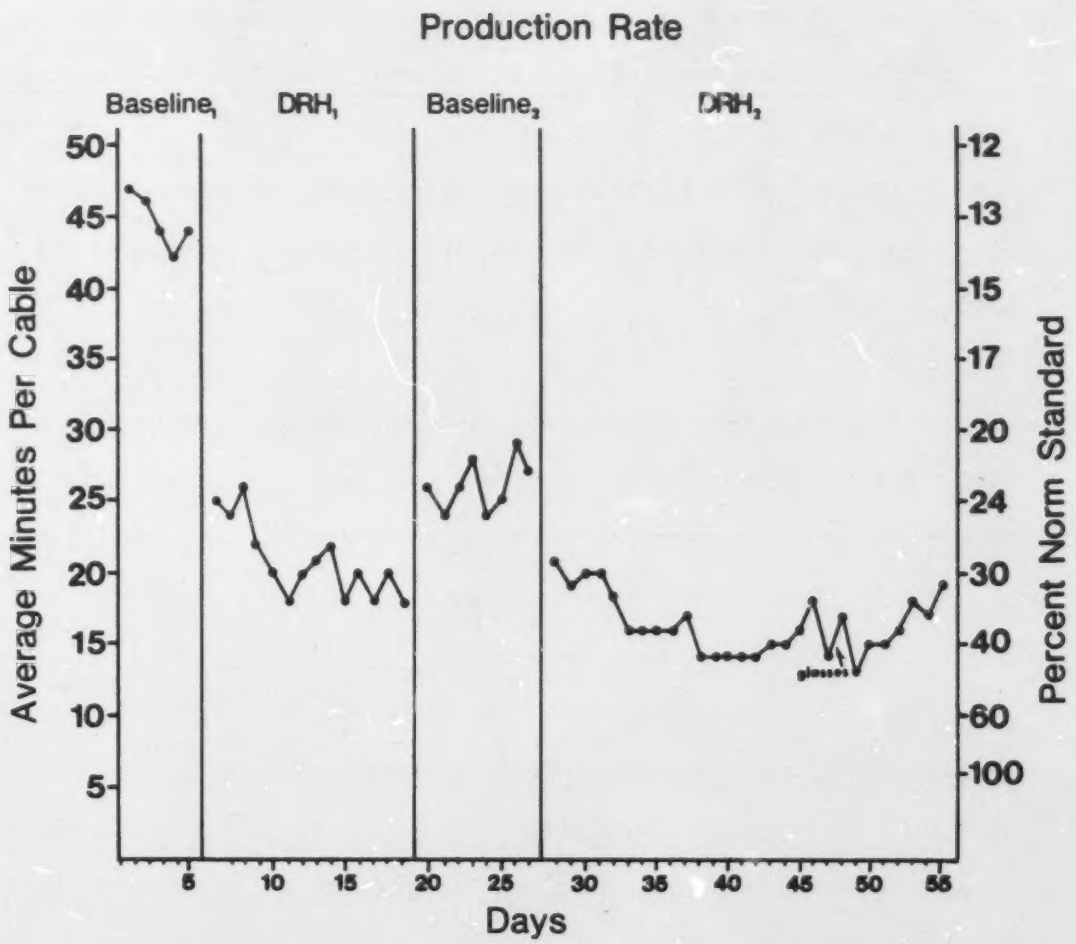

Figure 1. The average number of minutes per cable assembly, and the percent of norm standard per day across all phases for Eaon.

until he was working at almost 50% of the standard for normal workers performing the cable task.

Forty-seven days into the study Eaon received glasses. As shown in the DRH_2 phase, there was a gradual increase in the number of minutes taken per cable after he received his glasses. While lack of experimental control precludes discussion of any functional relationships, close observation of Eaon's behavior suggested this gradual increase may have been related to the excessive amount of time Eaon spent manipulating his new glasses. After each step in the task he would adjust his glasses. Further observation revealed that Eaon performed a variety of similar behaviors that were also irrelevant for completion of the task. It was felt that without these irrelevant behaviors Eaon's rate of performance would have been significantly closer to that of normal workers.

Discussion

Across the 55 days of the study Eaon's rate of performance improved from 13% to almost 50% of norm standard. The fact that the data follow an ABAB reversal pattern is strong evidence for a functional relationship between DRH procedures and improved production performance. These data replicate findings reported by Bellamy, Inman, and Yeates (Note 2). The present data, however, were collected in a community-based, rather than a university-based, workshop. Clearly the staff demands required to run such an individualized supervision program are not beyond the resources of a community facility.

In addition to demonstrating the effectiveness of the DRH procedure, data from the present study raise two concerns. The first comes from asking if a production rate of 40 to 50% norm standard should be considered

a success. Given that Eaon had demonstrated near normal performance rates during training, staff were hesitant to proclaim the study a success and terminate their intervention.

It would appear more realistic to view production rate as a complex behavior affected by many different variables. Manipulation of reinforcement schedules was clearly one of these variables for Eaon. Receiving glasses may have been another. The fact that rate stabilized and began to deteriorate during the last half of DRH_2 suggests that the effects of the DRH procedure may have been maximized, and further increases in performance rate would require manipulation of other variables. Unfortunately, the workshop in which data were collected is designed to run as a small business, not a research site. As such, both staff and employees must be responsive to the unpredictable demands of industry. Towards the end of the DRH_2 it became clear that Eaon would be needed for work on a different contract if production deadlines were to be met. This shift in work assignment forced termination of the study and precluded assessment of further manipulations.

A second concern raised by the data relates to the upward trend in minutes per unit over the last seven days of DRH_2. While a lack of experimental control prevents analysis of events functionally related to this trend, it is clear that Eaon's work rate was deteriorating. Staff observations indicating a high frequency of irrelevant behaviors suggest some loss of stimulus control. The extent to which a worker can perform at a high production rate will be dramatically affected by the degree to which work behaviors are under stimulus control. If this control breaks down or is suspended, work rate will suffer. The possible role stimulus control may

play in a worker's rate of production is hinted at by the present data, and dealt with more directly in the following Retraining study.

Retraining

When a worker completes training and enters production, s/he should be correctly performing each response required by a task, and each of the responses should be under control of task-relevant stimuli. Once in production some workers may increase their rate of performance without any further intervention (Bellamy, Inman, & Yeates, Note 2; Gold, 1973b). Unfortunately this pattern is not completely representative of severely and profoundly retarded workers as a population. Frequently a worker's production rate either markedly decreases during his or her time in production, or if some improvement does occur it still leaves the worker performing at a less than economically significant level. Observation of workers at Specialized Training Program sites suggests that one possible factor contributing to limited rates of performance is the addition of irrelevant behaviors to the operant chain of responses defining a task.

The addition of irrelevant behaviors (i.e., pauses, self-stimulation, realigning of the task, etc.) suggests that the stimulus control of task-relevant responses developed during training has broken down. Two likely possibilities are (a) that stimuli which had previously controlled task-relevant behavior have lost that control and now either serve as neutral stimuli or set the occasion for irrelevant responding, and/or (b) that non-task related stimuli in the production setting have greater control over irrelevant responses than task-related stimuli have over the task-appropriate responses.

Retraining is one programming strategy which may be useful for workers

whose production rate is inadequate due to poor stimulus control. Retraining refers here to termination of production management contingencies and reintroduction of one-to-one training contingencies (e.g., Bellamy, Inman, & Schwarz, in press). The objective of retraining is two-fold: (a) to regain stimulus control of task-appropriate responses with a trainer present, and (b) to transfer this control to task-relevant stimuli. This study evaluated the effects of retraining with one severely retarded worker.

Subject and Task

At the time of the study the subject, Judy, was 28 years old. She had been diagnosed as Downs Syndrome at birth and placed in a group home. At age 4 she was institutionalized. Institutional records label Judy as severely mentally retarded, at AAMD Adaptive Behavior Level IV. Approximately one year prior to the study Judy was removed from her institutional residence, and placed in a community group home facility. Simultaneously, she began employment in the Specialized Training Program.

Training procedures described by Bellamy, Inman, and Schwarz (in press) were used to train Judy on a vocational task which involved pasting cushioning tape in the four inside corners of an 18 cm tall funnel-like apparatus used by Tektronics, Inc., to shield electronics elements from heat. Specifications for correct tape placement were: (a) the tape itself had to measure no more than 4.4 cm and no less than 3.2 cm in length; (b) tapes needed to be positioned directly in the converging angles of the corner; and (c) tapes had to be no more than 2.46 cm and no less than .3 cm below the outer lip of the heat shield. Deviation on any of the above dimensions constituted an error.

During the first several weeks in production Judy performed the task at acceptable levels of efficiency and accuracy. It was not long, however, before she was observed to be adding pauses and extraneous movements to the task. Concomitantly her task efficiency and accuracy decreased.

Procedure

The study consisted of the following four phases: (a) Baseline; (b) Retraining; (c) Fading; and (d) Maintenance. Baseline data were collected on rate of production and frequency of errors during the four and one-half hours Judy was in production each day. During Baseline she received differential social praise for performing appropriate task-related behaviors and a token each time she completed three shields. Tokens were used to buy edibles at the end of work periods.

During the Retraining phase of the study one-to-one training was provided throughout the entire work day. One of three trainers would stand behind Judy while she performed the task in the production setting. The retraining intervention was intended to increase production rate, alleviate incorrect placement of tapes, bring appropriate responding under stimulus control, and eliminate the extraneous behaviors (pausing, excessive manipulation of parts, etc.) developed in the production environment. To this end, if Judy looked away from the task for more than two seconds a trainer would physically reorient her to the task. If she paused for more than three seconds a trainer would physically prime her on her right tricep. If Judy placed a tape incorrectly an immediate correction procedure was implemented in which she was prompted through a correct placement and then asked to perform the step again independently (O'Neill & Bellamy, in press). Correct tape placement was verbally praised

and task completion was rewarded with tokens. In addition, supervisors continued to deliver verbal praise for on-task behavior.

Fading began only after Judy was consistently performing her task at an average rate of 10 minutes or less in Retraining. The Fading phase was designed to gradually transfer control of on-task behavior from trainer provided stimuli to task and production setting stimuli. During Fading both proximity of the trainer and density of reinforcement were gradually changed to approximate the proximity of production supervisors and density of reinforcement normally occurring in the production setting.

During Retraining trainers stood next to Judy and delivered praise for correct placement of two consecutive tapes. In the Fading phase, this schedule was gradually leaned out to every third tape, then every fourth tape and so on until only after correctly completing three shields was praise delivered. In addition, trainer proximity and level of attention were faded. Trainers began by simply standing further away from Judy as she worked, and then gradually increased the physical distance between themselves and Judy, and then gradually decreased the overall amount of individual attention she received.

The final phase of the study was designed to be a long-term assessment of how well gains developed in Retraining were maintained. A vacation and contract completion interrupted data collection five days into the phase. After a several week pause Judy returned to the shield contract. The last two data points in the maintenance phase were collected four months after she had returned to shield production. During the maintenance phase procedures replicated those of the initial baseline phase except error data were not collected.

Results

The rate and error data across all phases of the study are provided in Figures 2 and 3. Baseline data indicate that Judy was assembling shields at an average of between 22 and 88 minutes per shield. Her minute/unit rate was extremely variable during the seven days of Baseline, and considerably higher than the 1.2 minutes required by normal workers. Her error data during Baseline indicated a similar trend towards high variability and poor performance.

Insert Figures 2 and 3 about here

Retraining produced a marked reduction in both level and stability of Judy's production rate. During the five days of Retraining she required an average of only 7.8 minutes to complete a shield. This is a substantial improvement over her baseline performance. In addition, her error rate stabilized and began steadily dropping.

Data from the Fading phase indicate a slight upward trend in the number of minutes Judy required to assemble a shield. Conversely, the number of errors gradually reduced to a negligible rate.

The initial five days of maintenance indicate that Judy's production rate was not maintaining. The trend established during Fading continued, and a slight increase in variability was observed. The final two points taken four months after she returned to production indicate a substantial loss of the gains developed during Retraining. Judy's rate had returned to a level near that observed during Baseline.

Discussion

The marked improvement in both rate and error performance when Retraining was first implemented suggests that antecedent and/or consequent

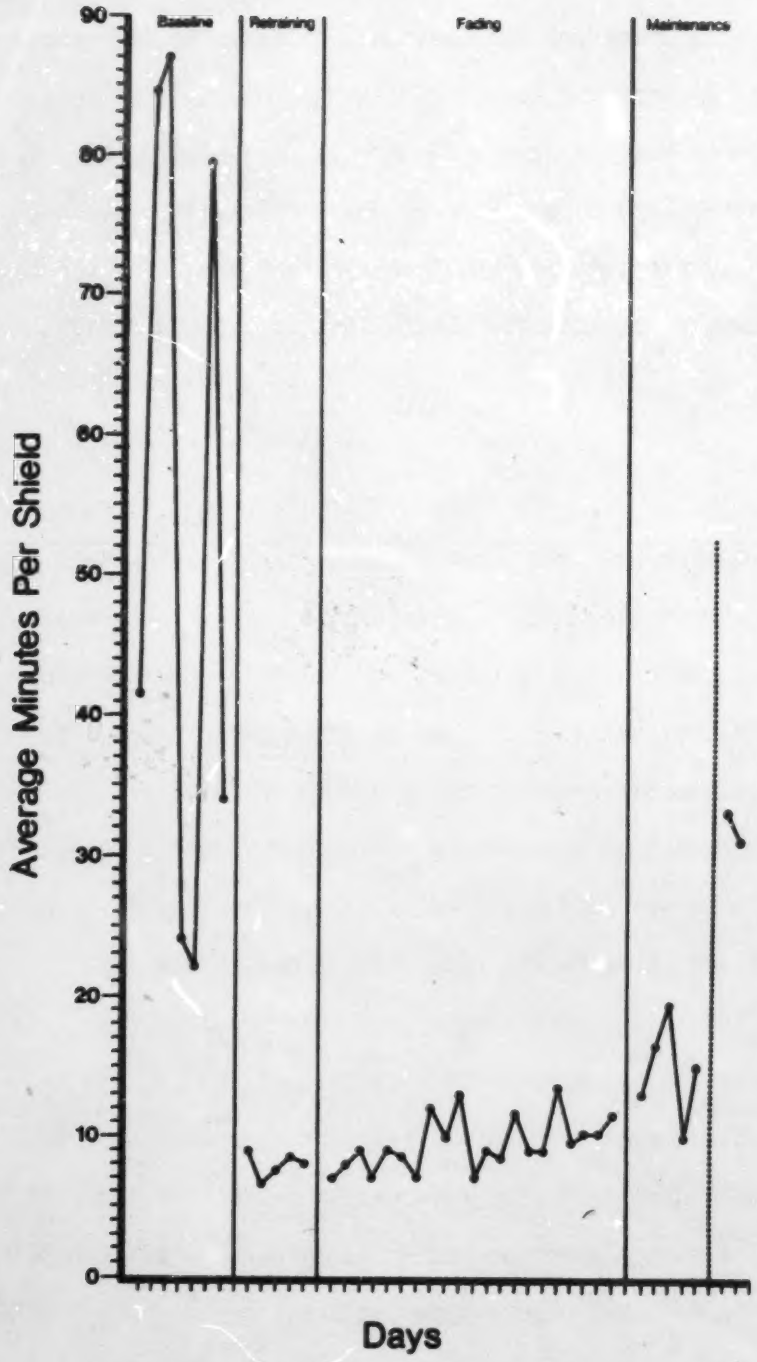

Figure 2. The average number of minutes per heat shield per day across all phases.

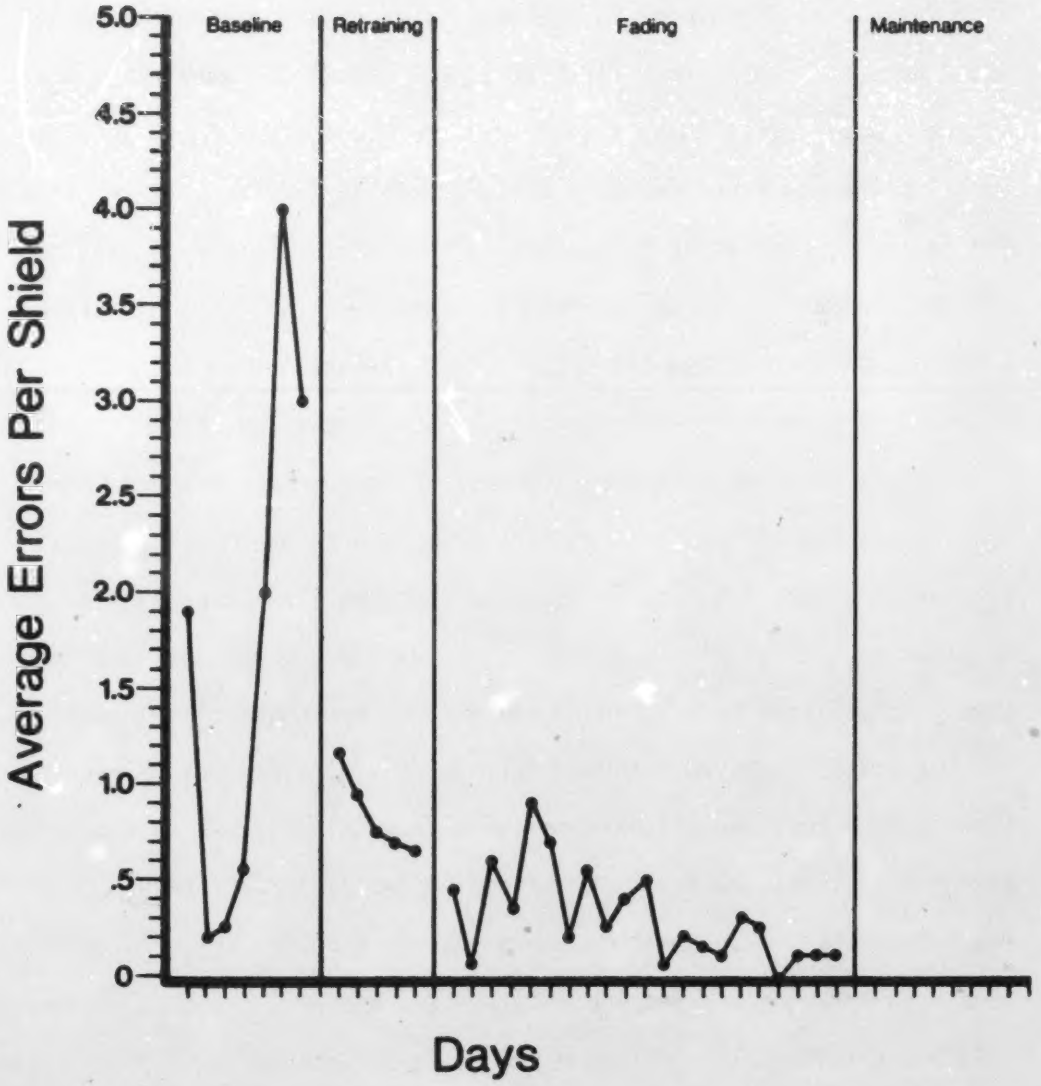

Figure 3. The average number of errors per heat shield per day across all phases.

events associated with trainer-provided stimuli may have affected Judy's behavior. This would be expected given the high density of reinforcement used during Retraining. It was anticipated that over time stimuli associated with Retraining (i.e., task, setting and trainer stimuli) would come to act as discriminative stimuli (S^Ds) for working at a fast, accurate pace. Once these stimuli had come to control fast, accurate work the intervention procedure was designed to fade out trainer stimuli. The Fading process would theoretically facilitate transfer of any control maintained by trainer stimuli to stimuli provided by the task or setting. In either case the worker would be expected to maintain high rates of performance without continuous one-to-one contact.

Judy's data indicate that the desired improvement occurred during Retraining, but that as soon as Fading procedures began her rate gains started deteriorating. It is possible this was a function of the short duration of the Retraining phase. Stimulus control may not have been firmly established before Fading began. Another possibility, however, is that Judy's improved behavior during Retraining was not related to the positive contingencies associated with Retraining but to avoidance of negative contingencies. The effect of Retraining may have been to teach Judy that if she wanted to avoid being prompted or corrected she needed to work quickly and accurately. If this were the case, trainer-related stimuli would still be expected to produce improved production behavior. However, it would be unlikely that the Fading procedure would effect transfer of stimulus control from trainer-related to task-related stimuli. As such, a loss of control similar to that observed over the Fading and Maintenance phases would be expected when trainer cues were

removed. This analysis would mesh with the fact that error performance did not deteriorate during Fading. Errors during Fading continued to be corrected even though they occurred at a low rate.

The above analyses are but two of many that would fit the data. Unfortunately, the present design is open to analysis from a wide variety of perspectives due to its lack of experimental control. Judy's data do, however, raise several issues pertinent to production rate programming with the severely retarded. The first is the importance of evaluating any intervention strategy based not only on its immediate effect, but on maintenance of that effect. Regardless of the type of manipulation or intervention used, long-term maintenance is an absolutely pivotal dimension against which the success of an intervention should be measured The present intervention did not meet this criterion of success.

The second issue relates to the fact that Retraining was implemented only after Judy had spent several weeks performing the task with numerous sets of extraneous behaviors. Over time a number of stimuli in the production environment may have come to control inadequate performance. It would not be surprising then that elimination of such behavior did not occur after only five days of Retraining. This suggests that managers in production settings should intervene at the earliest possible moment once consistent patterns of inappropriate behavior are identified. Early intervention would both prevent the worker from repeatedly practicing the inappropriate behavior, and minimize the extent to which work setting stimuli come to control the inappropriate responses. Clearly the most effective way to recognize consistent inappropriate behavior patterns will be through maintenance of a well-organized system of data collection (e.g., Bellamy, Inman, & Horner, in press).

A final issue raised by the present study revolves around the cost in staff time required to retrain. The Retraining intervention utilized 90 minutes per day from three staff members over a period of 26 days in an attempt to rectify production inadequacies. Even if the program had been completely successful the expense in staff time would have been substantial. This suggests that careful consideration should be given to original training and production variables that may preclude the need for retraining. These considerations suggest a few more days be spent in original training, or some extra production manipulations when rate first begins to decline, in order to reduce retraining costs.

Self-Delivery of Reward

Acquisition of vocational skills by severely retarded individuals will be economically practical only if those skills can be performed at a competitive rate, with a minimum degree of supervision. A number of researches addressing this issue have found that contingent delivery of reinforcement is one effective method of improving production rate (Bellamy, Inman, & Yeates, Note 2; Crosson, 1967; Martin & Pallotta, in press; Zimmerman, Stuckey, Garlick, & Miller, 1969). As yet, however, it is unclear how this reinforcement can be delivered without a substantial time commitment from supervisory staff. One possible method of providing a high density of reinforcement with a minimum cost in staff time can be found in literature on self-management.

Self-management techniques with normal populations have proven effective methods of controlling behavior (Mahoney & Thoresen, 1974; McLaughlin, in press; Miller, 1975). Recently, techniques such as self-delivery of reward, and self-monitoring have been used successfully with

exceptional populations (Helland, Patuck,& Klein, 1976; Horner & Brigham, Note 3). Data from these studies suggest: (a) that individuals with low IQs can learn to reliably self-deliver consequences for their own behavior, and (b) that self-delivered rewards are as effective as staff delivered rewards. One study conducted in the Specialized Training Program has examined the effects of self-delivered rewards on the production rate of a severely retarded worker.

Subject and Task

The subject participating in the study, Phil, was 32 years old at the time the study was conducted. Phil had been institutionalized 11 years of his life and his files indicated severe mental retardation attributed to Downs Syndrome. Phil entered the production setting following intensive one-to-one training at the Specialized Training Program (Bellamy, Inman, & Schwarz, in press). When training was complete he could perform each of the 34 steps required to assemble a 10 part test adapter used by Tektronics, Inc. The standard time required by a normal worker to perform the assembly was 10 minutes. After several months in production, however, Phil was averaging almost twice this time for task assembly.

Setting

Phil assembled adapters in an 802 square foot room with thirteen other workers employed on other contracts. Two supervisors circulated throughout the room delivering social praise for on-task behavior, and ensuring that all workers had sufficient parts and equipment. When Phil completed an adapter he would raise his hand, and a supervisor would inspect the quality of his work. If the adapter did not meet industrial

quality standards, Phil was shown his error and asked to redo the unit. If the adapter met industry standards he was praised, given a token, and the number of minutes required to complete the adapter was recorded. Tokens were exchanged later in the work day for edibles.

Procedure

The four phases of The study included $Baseline_1$, $Self\text{-}Delivery_1$, $Baseline_2$ and $Self\text{-}Delivery_2$. During both Baseline phases, supervisors delivered tokens and praise for work completion. During the Self-Delivery phases the subject delivered his own tokens. The frequency of supervisor praise for on-task behavior was held constant across all phases of the study. Supervisor praise for work completion, however, was not delivered during the self-delivery phases.

The first Baseline phase began after Phil had been in the production setting for several months. This phase lasted 34 days, and followed the production setting procedures described above. Following the $Baseline_1$ phase, a 2-day training period was conducted in which Phil was taught to do his own quality control checks. Given that the only errors Phil ever made involved insufficient tightening of screws, the quality control procedures required him to shake the adapter after he had completed assembly. Quality control standards were met if the adapter did not rattle. If the adapter rattled when shaken it did not pass the quality inspection. Upon hearing the rattle, Phil would raise his hand, and receive specific directions from a supervisor on what to correct. If the adapter did pass the quality control inspection he would place it in a box, and activate a small wooden lever which pushed one token onto his work bench. The tokens were accumulated during 90 minute work periods, and were exchanged for edibles at the end of each work period.

When Phil self-delivered the token a bell automatically sounded. The bell was a signal to supervisors to record the number of minutes required to complete an adapter. This ensured that data recording procedures were constant across all phases. All adapters Phil identified as meeting quality standards were later inspected by supervisors at the end of the work period.

Self-Delivery$_1$ procedures were in effect for 31 work days. At this point Baseline$_2$ conditions were introduced. Inspection and delivery of reinforcement were again done by supervisors. The second Baseline phase lasted 24 days before self-delivery procedures were reinstituted. The Self-Delivery$_2$ phase lasted 26 days and replicated Self-Delivery$_1$ exactly.

Results

Data across the four phases of the study are provided in Figure 4. During the 34 days of the first Baseline phase, Phil worked an average of 19 minutes to complete an adapter. In the first self-delivery phase, however, he improved this rate of productivity, requiring an average of only 12 minutes to complete an adapter. Across the last 10 days of Self-Delivery$_1$ a mean of only 10 minutes per adapter were required.

Insert Figure 4 about here

When Baseline$_2$ procedures were introduced, Phil's rate of productivity returned to a level near that observed in the original baseline phase. During the last 12 days of Baseline$_2$ an average of 21 minutes were taken to complete each adapter.

A dramatic reversal in the number of minutes taken per unit was

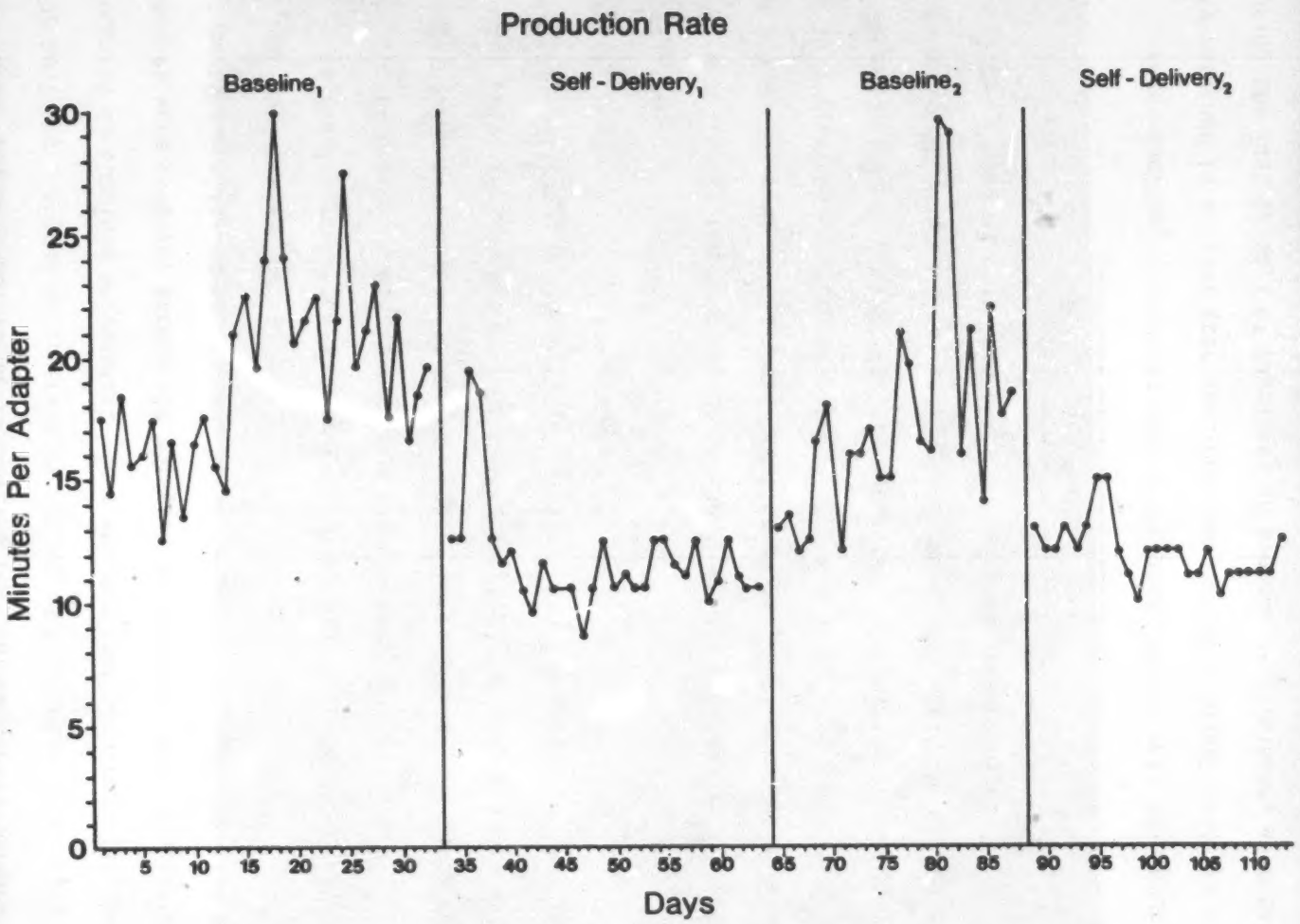

Figure 4. The average number of minutes required to assemble an adapter per day over all phases.

noted when Phil again started self-delivering reward. During the Self-Delivery$_2$ phase just under 12 minutes were taken to complete each adapter. The temporal link between change in method of reinforcement across phases, and change in production rate argues strongly that self-delivery of reward was functionally related to improved performance.

Throughout the study Phil self-delivered incorrectly only twice. On both occasions he gave himself two tokens instead of one. One of these instances was due to a clogging of the token-delivering apparatus. Phil never self-delivered a token for unacceptable work. This may be due in part to the easily discriminable quality control standards required by the task.

Discussion

This study replicates data reported by Helland, Patuck and Klein (1976) indicating that severely retarded individuals can be trained to accurately self-deliver reward. However, Helland, et al., found that self-delivery and external delivery of rewards were equally effective in controlling behavior (Bandura, 1969; Helland, Patuck & Klein, 1976; Mahoney & Thoresen, 1974). The present data indicate that self-delivered rewards were not only as effective, but more effective than supervisor delivered rewards. This is a curious finding given that the same tokens were delivered on the same schedule across all phases of the study. It is possible that access to the token-delivery apparatus, was, in itself, reinforcing. If this were the case, however, it might be expected that the effect would attenuate over the several weeks of each self-delivery phase. This did not occur. It is also possible that self-delivery of tokens increased the reinforcing value of the token. Further study of this possible effect is clearly needed.

The present results strongly suggest that self-management techniques should be further explored in workshop settings. These techniques may be valuable methods of improving and maintaining high levels of performance. Future research should assess not only the effects self-delivery has on production rate, but its effect on supervisor time and overall shop efficiency.

Drugs and Production Rate: An Unplanned Study

Severely and profoundly retarded adults often behave strangely by normal social standards. Nevertheless, it is increasingly apparent to those who work with these individuals that their strange behaviors "make sense" as a means of adapting to the demands of their environments. In the workshop situations described in this paper, a pervading assumption is that behavior is usually some sort of adaptation to an environment. Thus, behavioral change procedures are developed by focusing one's attention upon the identification of both the stimuli and the consequences functionally related to performance of a given kind of deviant behavior. Attempts to change behavior then involve the systematic manipulation of the environmental antecedents and/or consequences of that behavior.

Many clinical environments, however, practice a form of behavior management based upon a "medical or pathological model" of psychopathology (Goldiamond, 1974). As a result, unusual behavior patterns, which often contribute to an individual being labeled severely or profoundly retarded, are seen as an overt representation of an underlying pathological condition implying organic or biological defects.

From the point of view of the medical model, the logical treatment of choice is frequently one, or commonly a combination, of the wide variety of biologically mediated psychoactive drugs now universally available. Unfortunately, the effect of some psychoactive drugs extends beyond the environment in which the medical model is prevalent and into environments where the behavioral model is functioning effectively.

The present study is an example of the effect one particular drug had on one worker in a workshop setting. The data are drawn from an unplanned study and are available only because it is normal procedure to carefully monitor, by means of daily up-dated graphs, the production rates of each severely or profoundly retarded worker.

Subject and Task

Lani was one of the first severely retarded entrants into Alpha Production Technologies, Inc., a community-based replication of the Specialized Training Program. In the course of her first six months in the program Lani was systematically trained on increasingly complex assembly tasks. Each of Lani's assembly tasks was organized by means of chaining individually easy steps into more complex organizations of productive behavior (Bellamy, Inman, & Schwarz, in press). At the time of the unplanned study, she was fully independent in her assembly of an eleven-piece grounded extension cord plug which required approximately fifty individual assembly steps. Lani's average time-to-completion for one plug was 5.5 minutes. Normally she would work steadily in each of her four, one and one-half hour work periods. She was cheerful, relatively industrious, and socialized well with her co-workers and staff. Lani's only bizarre behaviors were the biting of a large oval callous on her right forearm and a rocking motion which she would

occasionally intensify to the point of bringing her head into damaging contact with whatever was behind her. These behaviors had dropped to a low rate following implementation of contingent staff praise for appropriate behavior, and ignoring of biting and rocking behavior. This drop demonstrated Lani's responsiveness to basic behavioral manipulations.

Procedure

The three phases of the present study assess the effects of a commonly used psychoactive drug (Haldol), on Lani's production rate. The phases of the study were Baseline$_1$, Haldol, and Baseline$_2$. The dependent measure across all phases was production rate measured by the average number of minutes required for assembly of extension plugs. The independent variable was the administration of Haldol in Lani's home environment.

Baseline$_1$ involved normal production procedures similar to those described earlier. At home, however, Lani was receiving 5.4 mg/kg (300 mg) of Mellaril per day. This medication was one she had been taking for a substantial time period.

The Haldol phase began when managers in Lani's home environment arranged to have her medication shifted from 5.4 mg/kg of Mellaril to .09 mg/kg (5 mg) of the more potent drug, Haldol. The administration of Haldol was precipitated by Lani's excessive negativeness and tantruming in the home setting. The change was made without the knowledge of the workshop staff. Haldol was administered for 4 days.

The Baseline$_2$ phase replicated procedures in Baseline$_1$. Lani was shifted back to her original 5.4 mg/kg of Mellaril.

Results

Lani's average rate of production across all phases of the study is provided in Figure 5. During the 15 days of Baseline$_1$, she averaged 5.5 minutes per plug assembly. This is approximately 50% of the standard industrial rate for this task.

In the medication condition there was a dramatic increase in the average number of minutes taken per plug. The slope of the production rate data during this phase clearly indicates a substantial deterioration in Lani's performance.

Insert Figure 5 about here

Accompanying Lani's change in production rate were equally noticeable changes in her overall behavior. She fell asleep during lunch, drowsed during work and became self-abusive when attempts were made to prompt her to work. A consultation with her home staff was held at which time workshop staff were informed of the medication change. Following analysis of Lani's production rate graph, staff from both workshop and home environments agreed to reimplement her original medication schedule. Following return to Mellaril, Lani's production rate immediately returned to Baseline$_1$ levels.

Discussion

The above data clearly indicate that Lani's production rate was functionally related to the change from Mellaril to Haldol. The generaizability of these results is somewhat limited, however, given that (a) there is no data to suggest what effects Mellaril had on Lani's behavior; and (b) no placebo controls were used.

The dramatic effect the medication change appeared to have on Lani's behavior does, however, require consideration by individuals responsible

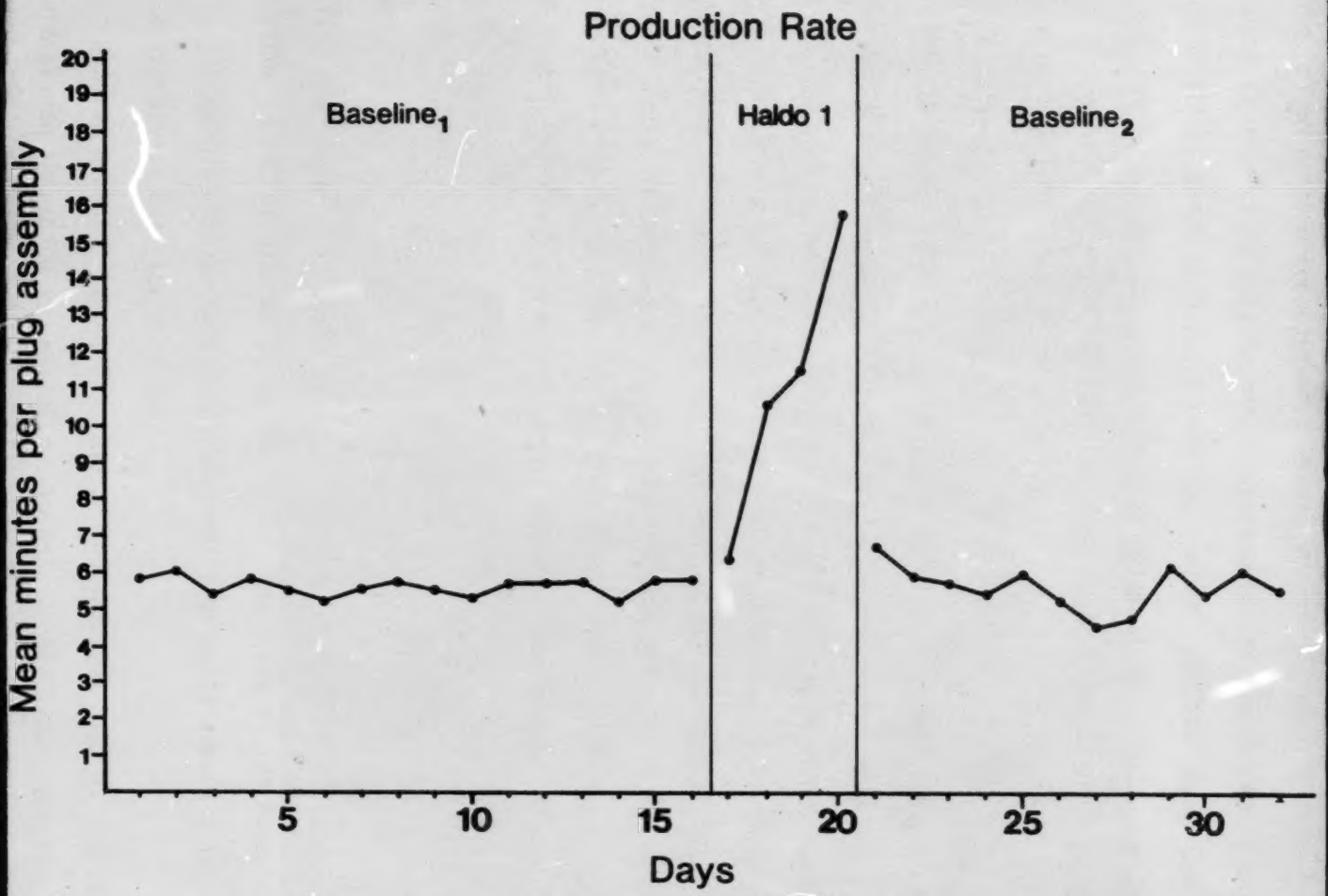

Figure 5. The average number of minutes required per plug assembly per day over all phases.

for managing the environments of severely and profoundly retarded adults. If our goal is to help a population of disadvantaged individuals by enabling them to be involved in the productive activities of our society, then they should be given an opportunity which is as favorable to their success as possible. Where being involved in society's productive activities translates into an interest in high rates of behavior, certain kinds of commonly prescribed drugs may be inimical to successful socio-economic integration.

If a drug (stimulant or suppressant) is used to control the behavior of a retarded individual, careful consideration should be paid to the effects the drug will have on all aspects of the individual's behavior, not just its effects on a specific targeted behavior. Subjective reports from staff in Lani's home environment indicated that Haldol was effective in reducing her frequency of negative and abusive behavior. Yet, the drug was also effective in reducing a large percent of all of Lani's behavior (acceptable and unacceptable). The decision to drop administration of Haldol with Lani was made partly because the effects of the drug were seriously impeding her ability to behave adaptively in the workshop, and partly because she had demonstrated a marked responsiveness to behavioral intervention in the workshop setting. It was felt that a more responsive method of dealing with Lani's negative behavior would be to manage antecedents and consequences specifically related to that negative behavior. Such a program is currently being implemented.

If normalization, deinstitutionalization, and increased independence are to become terms that have a positive functional meaning for severely and profoundly retarded adults, emphasis must be placed not simply on

reducing negative behaviors, but on training positive (adaptive) behavior. If a treatment designed to alter a negative behavior seriously impedes an individual's ability to perform appropriately, that treatment should be carefully reviewed prior to implementation. One aspect of this review process should include demonstration that less intrusive treatment strategies, such as those of applied behavior analysis, are impractical.

Conclusions

The four studies discussed above provide a variety of perspectives from which the low production rates of some severely and profoundly retarded workers can be assessed. Each of the studies discusses variables which may affect individual productivity. Given that the significance of vocational training with the severely retarded will largely rest on the rate at which workers perform, it is imperative that researchers and production managers begin clearly identifying those variables which affect rate.

The above studies indicate that the speed at which a worker performs is a complex behavior. It may be affected by a variety of stimulus situations or schedules of consequation. As yet, we have only a very global understanding of production rate issues. One important area of research need with the severely handicapped continues to be a fine-grained analysis of variables affecting production rate.

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